



Ichneumonidae (Hymenoptera) associated with xyelid sawflies (Hymenoptera, Xyelidae) in Mexico

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Abstract

Two species of ichneumon wasps (Ichneumonidae), *Gelanes horstmanni* Khalaim, **sp. n.** (Tersilochinae) and *Idiogramma elbakyanae* Khalaim **sp. n.** (Tryphoninae), are described from the pine forest at 2800–2900 m from the State of Tlaxcala in Central Mexico; a third species, *I. comstockii* (Ashmead), is found to occur in the State of Nuevo León in Northeast Mexico. The genera *Gelanes* Horstmann and *Idiogramma* Förster are associated with xyelid sawflies (Xyelidae), and both, as well as the tryphonine tribe Idiogrammatini, are recorded from Mexico for the first time. An identification key to the two *Idiogramma* species occurring in Mexico is provided.

Resumen

Se describen dos especies de Ichneumonidae, *Gelanes horstmanni* Khalaim, **sp. n.** (Tersilochinae) e *Idiogramma elbakyanae* Khalaim **sp. n.** (Tryphoninae), de un bosque de pinos a 2800–2900 msnm en el Estado de Tlaxcala en la zona central de México; una tercera especie, *I. comstockii* (Ashmead), se reporta del Estado de Nuevo León en el noreste de México. Los géneros *Gelanes* Horstmann e *Idiogramma* Förster están asociados con moscas sierra xyelidas (Xyelidae), ambos géneros y la tribu Idiogrammatini de la subfamilia Tryphoninae se reportan para México por primera vez. Se elaboró una clave para la identificación de las dos especies de *Idiogramma* que ocurren en México.

Keywords

Tersilochinae, *Gelanes*, Tryphoninae, *Idiogramma*, Tlaxcala, fauna, new species, taxonomy, parasitoids, key

Introduction

The family Xyelidae Newman is an ancient group of Hymenoptera with the oldest fossil representatives dating back to the Middle or Late Triassic (Gao et al. 2009, Wang et al. 2014). Extant Xyelidae fauna is represented by five genera, of which the most diverse and species rich is *Xyela* Dalman (Taeger et al. 2010).

The genus *Xyela* comprises 48 species occurring predominantly in the Holarctic region, though some species extend with their host plants, *Pinus* spp. (Pinaceae), southwards into northern parts of the Neotropic and Oriental regions (Blank et al. 2013). A small number of imagines of *Xyela* are known from Mexico (Smith 1988; Khalaim, unpublished data), but none has been identified at species level so far. Larvae of *Xyela* live and feed in male cones of pine species (Blank 2002, Blank et al. 2013) but *X. gallicaulis* D.R. Smith causes galls in the vegetative shoots (Yates and Smith 2009). Some European species of *Xyela* were demonstrated to be monophagous or exceptionally oligophagous, being associated with one or a few related *Pinus* species (Blank et al. 2013).

The ichneumonid parasitoid complex of *Xyela* includes a small Palaearctic genus, *Xyeloblasticus* Achterberg (Braconidae), and two Holarctic genera, *Idiogramma* Förster and *Gelanes* Horstmann (Ichneumonidae) (Achterberg and Altenhofer 1997, Khalaim and Blank 2011, Horstmann 2013). None of these taxa were reported from Mexico hitherto. In addition, the Nearctic *Eurytoma tylodermatidis* Ashmead (Eurytomidae) and *Pteromalus thyridopterigis* (Howard) (Pteromalidae) are known to occur on *Xyela* species (Hetrick 1942, Burdick 1961, Peck 1963, Noyes 1998).

The aim of this work is to describe two new species of *Gelanes* and *Idiogramma* from Central Mexico and record one more Nearctic *Idiogramma* species from Northeast Mexico. An identification key to two Mexican species of *Idiogramma* also will be provided.

Material and methods

A large amount of material of Mexican Ichneumonidae from the Instituto de Biología, Universidad Nacional Autónoma de México, DF, Mexico (further UNAM) was examined. From this material, two undescribed species of Ichneumonidae belonging to the genera *Gelanes* and *Idiogramma* have been recognized. One more Nearctic species associated with *Xyela* was found in the collection of the Universidad Autónoma de Tamaulipas, Cd. Victoria, Mexico (further UAT). Some specimens will be deposited in the Natural History Museum, London, United Kingdom (further BMNH) and the Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia (further ZISP).

Samples of the following Nearctic species of *Idiogramma* were examined in the Texas A&M University, U.S.A. (further TAMU): *I. comstockii* (Ashmead) (1 male, USA, Maryland), *I. contortae* Townes & Townes (8 females, USA, Wyoming) and *I. longicauda* (Cushman) (1 female, USA, Maryland). Samples of three Palaearctic species, *I. alysiina* (Thomson), *I. eurum* Kasparyan and *I. euryops* Förster, were examined in ZISP and the Finnish Museum of Natural History, Helsinki University, Helsinki, Finland.

Morphological terminology generally follows Gauld (1991); nomenclature of *Gelanes* propodeal carinae and areas follows Khalaim (2011). Ocellar index is the shortest distance between the lateral ocellus and the margin of the eye compared with the maximum diameter of the lateral ocellus. Stacks of photographs were taken in the TAMU with a DFC 295 digital camera attached to a Leica stereomicroscope. Composite images with an extended depth of field were created using the Helicon Focus software.

Taxonomy

Gelanes Horstmann, 1981.

Type species. *Thersilochus fuscus* Holmgren, 1860.

Gelanes is a Holarctic genus with 20 species in the Palaearctic region (Horstmann 1981; Khalaim 2002, 2017; Khalaim and Blank 2011; Kim et al. 2013; Khalaim and Sheng 2015) and 13 described and many undescribed species in USA and Canada (Horstmann 2013). Some species were reared from *Xyela* spp. in Europe (Khalaim and Blank 2011) and *Xyela* spp. and a species of *Pleroneura* Konow (Xyelidae) in North America (Horstmann 2013). A single species of *Gelanes*, described below, is found in Central Mexico. It represents the first record of *Gelanes* from Mexico.

Gelanes horstmanni Khalaim, sp. n.

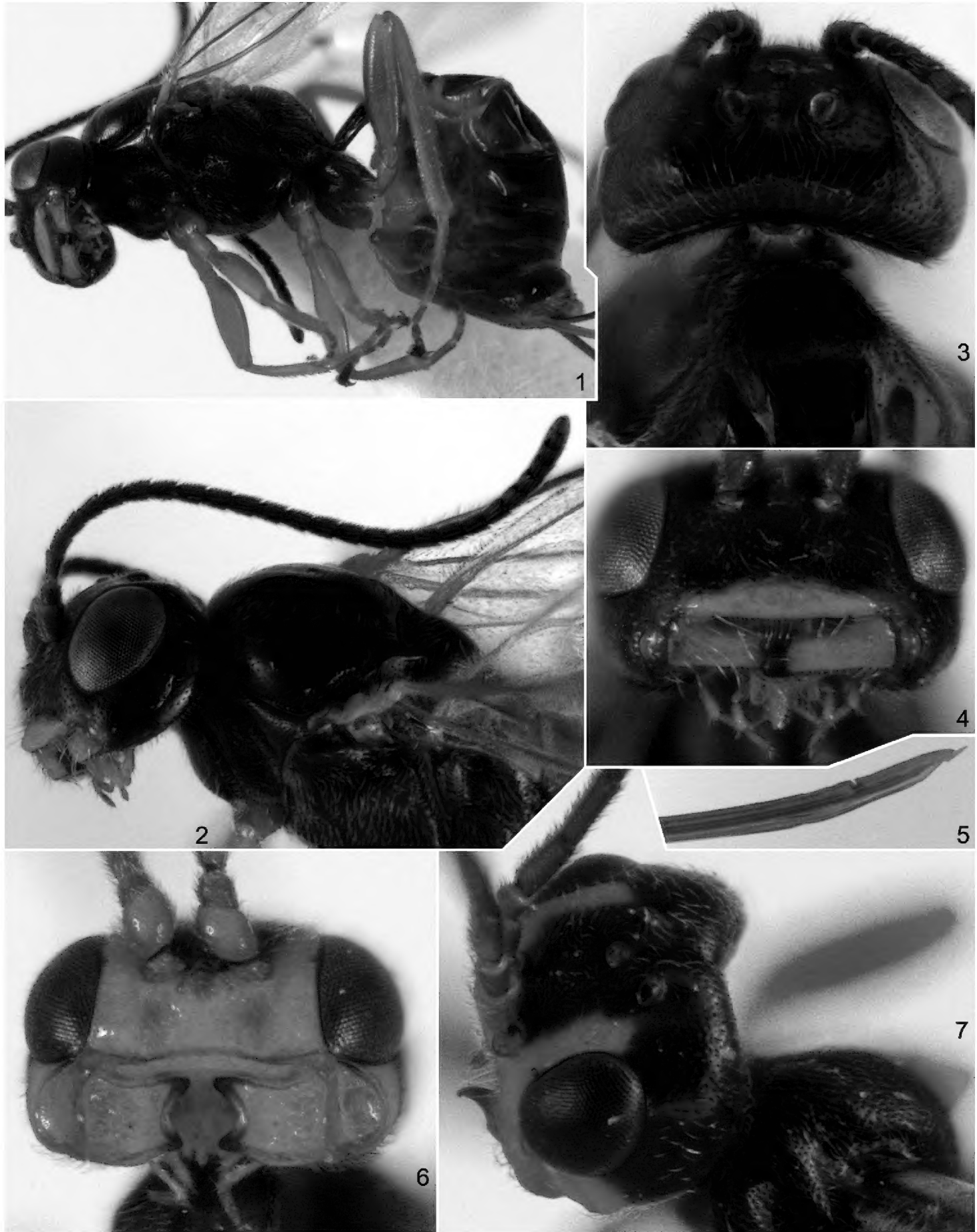
<http://zoobank.org/01626456-87CC-4A73-99BF-492D8C8DD836>

Figs 1–5

Comparison. The new species is immediately distinguished from the 13 Nearctic species described by Horstmann (2013) by the combination of the filiform flagellum comprising 25 flagellomeres (Fig. 2) and the ovipositor bearing a deep and narrow dorsal subapical notch (Fig. 5). Only two Nearctic species, *G. incisus* Horstmann and *G. punctipleuris* Horstmann, possess similar ovipositors with a narrow dorsal subapical notch, but in both species the genae are much shorter (0.6–0.7 times as long as eye width) and more strongly constricted behind the eyes, the clavate flagellum comprises only 16–18 flagellomeres, and the apex of the ovipositor bears one or several fine teeth ventrally. In the key to Nearctic species (Horstmann 2013), *G. horstmanni* runs to couplet 14, but does not correspond with either side of the couplet as it has the mesopleuron punctate with smooth interspaces, a weak foveate groove, and an extremely long ovipositor with the sheath being more than 4.5 times as long as the first tergite. *Gelanes horstmanni* also differs from all of its Palaearctic congeners by the head strongly prominent behind the eyes in dorsal view (Fig. 3).

Description. *Female.* Body length 5.0 mm. Fore wing length 3.9 mm.

Head prominent, strongly rounded behind eyes in dorsal view (as in Fig. 3); gena 0.85 times as long as eye width. Ocellar index 1.7. Clypeus broad and short, 5.5 times



Figures 1–7. *Gelanes horstmanni* sp. n., holotype female (**1**, **2**, **4**, **5**) and paratype male (**3**). **1** body, lateral view **2** head with antenna and mesosoma, dorso-lateral view **3** head, dorsal view **4** head, antero-ventral view **5** apex of ovipositor, lateral view. *Idiogramma comstockii*, female **6** head, antero-ventral view **7** head, dorso-lateral view.

as broad as long (Fig. 4), flat in lower half, with lower margin almost straight. Mandible with upper tooth subequal in length and size to lower tooth; both teeth with apices widely rounded, probably obliterated because of use (Fig. 4). Malar space almost 0.9

times as long as basal mandibular width. Antennal flagellum (Fig. 2) filiform, long, with 25 flagellomeres; flagellomeres 1–3 rather short, slightly elongate; second flagellomere is the shortest; flagellomeres 4 and following 1.2–1.3 times, subapical flagellomeres almost 1.1 times as long as broad; flagellomeres 4–6 bearing distinct and flagellomere 7 weak finger-shaped structures at apex on outer surface. Face with moderately strong prominence medially. Face and frons distinctly punctate, with smooth interspaces between punctures centrally, finely and densely punctate with granulate and dull interspaces peripherally. Vertex distinctly punctate, smooth between punctures. Gena smooth, upper part with moderately dense and fine punctures, lower part with very fine and sparse punctures. Occipital carina complete. Hypostomal carina completely absent.

Mesoscutum and scutellum with moderately dense fine punctures, polished between punctures. Scutellum with lateral longitudinal carinae present only at extreme base. Notaulus very weak, slightly impressed, with few fine oblique striae somewhat distant from anterolateral margin. Mesopleuron with shallow fine punctures, more or less smooth and weakly shining between punctures centrally, finely granulate peripherally. Foveate groove rather shallow, short, oblique, situated somewhat before centre of mesopleuron, with fine transverse wrinkles. Basal area of propodeum indistinct, moderately broad, rectangular, about 2.5 times as long as broad and 0.4 times as long as apical area. Dorsolateral area with fine, scattered punctures, interspaces between punctures smooth centrally. Distance between propodeal spiracle and pleural carina about as long as diameter of spiracle. Apical area centrally indistinctly punctate with interspaces between punctures more or less smooth, peripherally uneven, flat, widely rounded anteriorly; apical longitudinal carinae well developed, reaching transverse carina anteriorly.

Fore wing with second recurrent vein ($2m-cu$) postfurcal. Intercubitus ($2rs-m$) moderately thick, somewhat longer than abscissa of cubitus between intercubitus and second recurrent vein (abscissa of M between $2rs-m$ and $2m-cu$). First abscissa of radius ($Rs+2r$) straight, distinctly longer than width of pterostigma. First and second sections of radius ($Rs+2r$ and Rs) meeting at right angle. Metacarpus ($R1$) short, running about half way from distal end of Rs and apex of fore wing. Postnervulus ($Cu\&2cu-a$) intercepted distinctly below its middle. Hind wing with nervellus ($Cu1\&cu-a$) vertical.

Legs slender. Hind femur 0.65 times as long as tibia (Fig. 1). Hind basitarsus short, 0.4 times as long as hind tibia. Spurs of hind tibia short and straight. Tarsal claws not pectinate.

First tergite moderately slender, 2.6 times as long as broad posteriorly, dorsally polished, laterally striate before glymma, smooth at base. Glymma deep, situated slightly proximal of centre of first tergite, joining strong furrow to ventral part of postpetiole. Second tergite 1.25 times as long as broad anteriorly. Thyridial depression slightly elongate. Ovipositor very long, evenly upcurved, with a deep dorsal subapical notch, without teeth ventrally (Fig. 5); sheath over 4.5 times as long as first tergite and about 3.0 times as long as hind tibia.

Head, mesosoma and first metasomal segment black. Palpi, mandible (except black teeth), clypeus and tegula yellow. Antennal flagellum black, scape and pedicel brown-

ish black. Pterostigma dark brown. Fore and mid legs brownish yellow, tarsi slightly infusate, mid coxa on outer half dark brown. Hind leg with coxa brownish black, femur predominantly brown (paler apically), trochanters and tibia yellow-brown, tarsus infusate. Metasoma behind first tergite yellow ventrally, brown to dark brown laterally, brownish black dorsally.

Male. Flagellum slightly tapered towards apex, with 24–25 flagellomeres. Head rather strongly prominent behind eyes in dorsal view (Fig. 3). Malar space 0.3–0.5 times as long as basal mandibular width. One male with mandibular teeth not obliterated, pointed, subequal in length. Clypeus more or less lenticular, with lower margin weakly convex. Basal area of propodeum narrow, almost as long as apical area. Distance between propodeal spiracle and pleural carina 1.0–2.0 times as long as diameter of spiracle. Tergites 1 and 2 of metasoma more slender. Metasoma posterior to tergite 1 dark brown, subcylindrical. Otherwise similar to female.

Variation. Six males are not included to the type series; they are somewhat smaller, with the gena not prominent behind eyes in dorsal view and the body highly smooth and less punctate.

Etymology. The species name is dedicated to the late Klaus Horstmann, a German expert in Ichneumonidae, in recognition of his contribution to the study of Nearctic Tersilochinae.

Material examined. Holotype female (UNAM), Mexico, Tlaxcala, Nanacamilpa, Ejido Los Búfalos, N 19°28', W 98°35', bosque Pino-Encino (*Pinus* + *Quercus* forest), 2830–2900 m, Malaise trap, 4.IV–3.V.2016, coll. Y. Marquez & A. Contreras.

Paratypes. 3 males (BMNH, UNAM, ZISP), same data as holotype.

Non-type material. 6 males (1 in BMNH, 4 in UNAM, 1 in ZISP), same data as holotype.

Distribution. Central Mexico (Tlaxcala).

Idiogramma Förster, 1869

Type species: *Idiogramma euryops* Förster, 1888.

Idiogramma is a small Holarctic genus with 6 species – 3 in the Palearctic region and 4 in the Nearctic region (Townes et al. 1992), including one species, *I. euryops*, distributed in both continents (Yu et al. 2012). Two species of *Idiogramma* are here recorded from Mexico: *I. comstockii* is recorded from the northeastern State of Nuevo León, and *I. elbakyanae* sp. n. from the State of Tlaxcala in Central Mexico. This is the first record of the genus, as well as its tribe Idiogrammatini, from Mexico.

Key to species of *Idiogramma* occurring in Mexico

- 1 Frons with deep median groove immediately posterior of anterior ocellus (Fig. 7). Mandible not tapering towards apex, as broad basally as apically

- (Fig. 6), in dorsal view with apex strongly turned outwards (Fig. 7). Face and frontal orbits yellow (Figs 6, 7). Ovipositor sheath (in Mexican specimen) 2.4 times as long as hind tibia..... *I. comstockii* (Ashmead)
- Frons posterior of anterior ocellus weakly convex, without median groove (Figs 10, 11). Mandible strongly tapering towards apex, much broader basally than apically (Fig. 9); in dorsal view convex, unspecialized. Face and frons black, at most face slightly yellowish brown centrally (Figs 9–11). Ovipositor sheath 4.2 times as long as hind tibia (Fig. 8)..... *I. elbakyanae* sp. n.

***Idiogramma comstockii* (Ashmead, 1895)**

Figs 6, 7

Material examined. 1 female (UAT), Mexico, Nuevo León, San Pedro Garza García, Chipinque, trampa luz negra, 10.IV.1986, coll. O. Cardoso.

Distribution. Canada, USA (south to California, Arizona and Louisiana), North-east Mexico (Nuevo León).

***Idiogramma elbakyanae* Khalaim, sp. n.**

<http://zoobank.org/BAD5B4AC-6C1C-42FC-99D1-BF14A66B971F>

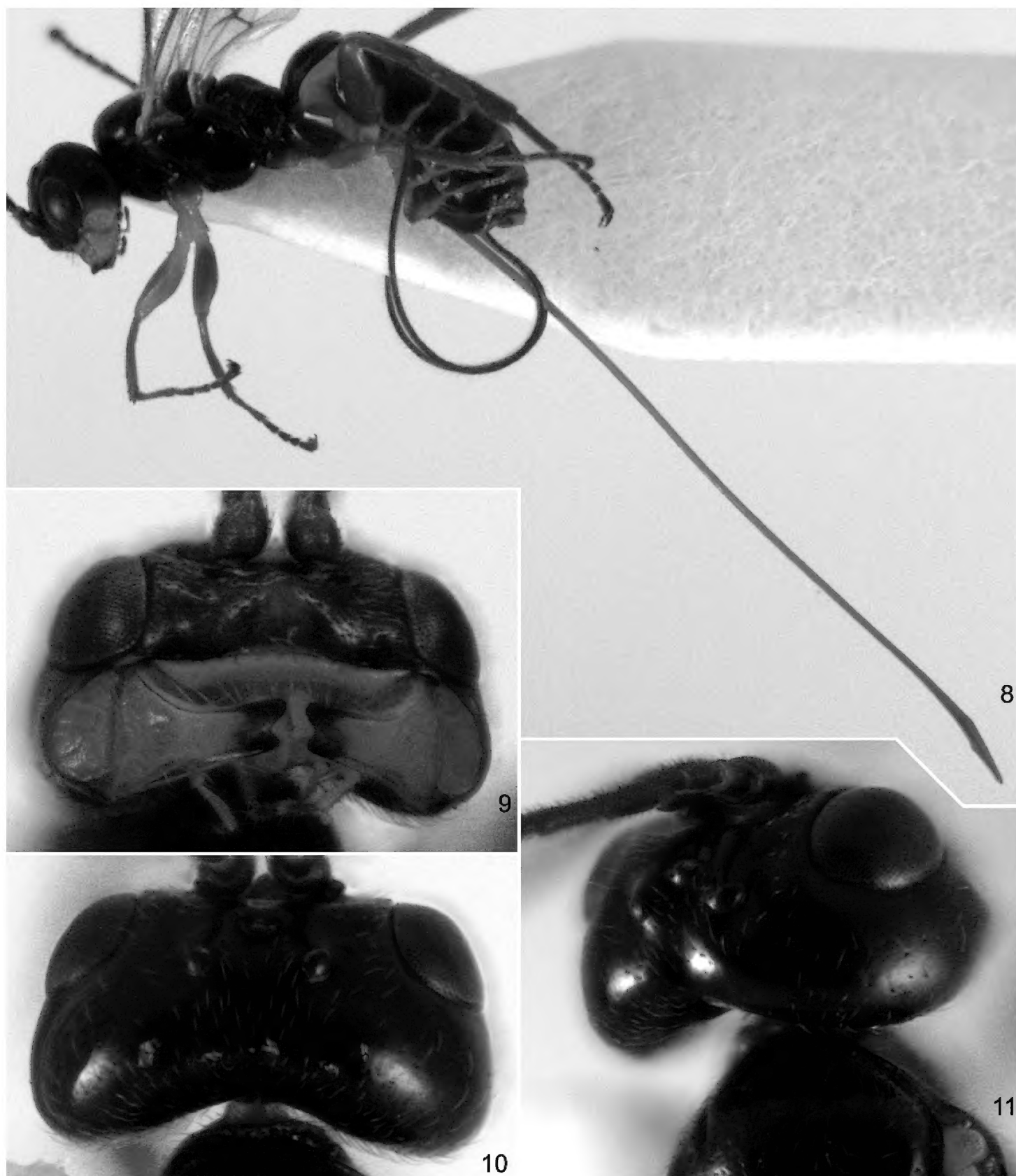
Figs 8–11

Comparison. The new species differs from all Nearctic species by the occipital carina absent dorsally and laterally (Figs 10, 11); the mandible strongly tapering apically (Fig. 9), in dorsal view unspecialized, convex (turned outwards in other species except *I. euryops* – as in Fig. 7); and the entirely black frons (Figs 10, 11).

In addition, *I. elbakyanae* differs from the three species occurring in the Palearctic region (Kasparyan and Tolkanitz 1999) by its extremely long ovipositor, shorter first tergite, strongly tapered mandibles and dorsally absent occipital carina (in *I. euryops* this carina is sometimes weak or vestigial mediodorsally); it also differs from *I. alysiina* and *I. euryops* by the head, in dorsal view, with long and prominent genae; and from *I. eurum* and *I. euryops* by the fuscous face (yellow in the two other species).

Description. *Female.* Body length 3.8 mm. Fore wing length 3.9 mm.

Head prominent, strongly rounded behind eyes in dorsal view (Fig. 10); gena 1.1 times as long as eye width. Ocellar index 1.8. Clypeus very broad and short, separated from face by deep and sharp groove, with upper margin somewhat convex medially and lower margin slightly concave (Fig. 9), strongly convex in lateral view. Mandible strongly tapered in basal half, 2.6 times broader basally than apically (at level of base of teeth), with raised flanges on lower and upper margins; upper tooth longer than the lower; mandible in dorsal view convex, unspecialized. Malar space very short, upper corner of mandible almost touching eye margin (Fig. 9). Antennal flagellum slender, slightly tapered towards apex, with 23 flagellomeres; flagellomere 1 slightly swollen



Figures 8–11. *Idiogramma elbakyanae* sp. n., holotype female **8** habitus (without antennae and wings), lateral view **9** head, antero-ventral view **10** head, dorsal view **11** head, dorso-lateral view.

basally. Face with rather strong prominence medially, finely punctate with smooth and shining interspaces between punctures. Frons, vertex and genae polished, with scattered fine punctures. Vertex weakly convex, not impressed along midline (Figs 10, 11). Occiput dorsally conspicuously impressed medially (Fig. 11). Occipital carina present ventrally, completely absent laterally and dorsally.

Mesoscutum polished, with scattered fine punctures. Notaulus deep and sharp on anterolateral side of mesoscutum. Epicnemial carina extending somewhat above the level of lower corner of pronotum, not reaching anterior margin of mesopleuron. Me-



Figure 12. Distribution map of *Gelanes* and *Idiogramma* species in Mexico.

sopleuron smooth and shining, with very fine and sparse punctures. Propodeum with median longitudinal carinae distinct, convergent anteriorly; propodeum dorsally with transverse wrinkles between median longitudinal carinae; lateral longitudinal carinae weak but distinct.

First tergite slightly transverse, almost 0.9 times as long as posteriorly broad, in lateral view with upper margin evenly convex; lateromedian carinae distinct in basal half. Second tergite strongly transverse. Ovipositor very long, flexible, at apex with distinct nodus and fine teeth ventrally (Fig. 8); sheath about 4.2 times as long as hind tibia.

Head brownish black to black; lower part of genae and face medially slightly yellowish; clypeus and mandible (except black teeth) yellow; mouthparts yellow with two apical segments of maxillary palp and one apical segment of labial palp fuscous. Antennal flagellum black, slightly paler basally; scape and pedicel brownish black, yellowish ventrally and with extreme apical margin yellow dorsally. Mesosoma entirely brownish black; tegula yellow. Pterostigma brown. Legs predominantly brown; fore coxa yellow, slightly brownish basally; mid coxa pale brown; fore and mid trochanters yellow; fore and mid femora and hind trochanters yellow to brown. Metasomal tergites dark brown, tergites 2 to 7 with hind margin dorsally widely and laterally narrowly emarginate with yellow (Fig. 8).

Male. Very similar to female but metasoma basally more slender, tergite 1 almost twice as long as posteriorly broad, tergite 2 subquadrate and yellow markings on tergites 2–7 generally narrower (especially on tergite 2). Occipital carina sometimes dis-

cernible ventro-laterally. Face sometimes yellowish medially and laterally. Measoma and legs sometimes darker.

Material examined. Holotype female (UNAM), Mexico, Tlaxcala, Nanacamilpa, Ejido Los Búfalos, N 19°28', W 98°35', bosque Pino-Encino (*Pinus* + *Quercus* forest), 2830–2900 m, Malaise trap, 4.IV–3.V.2016, coll. Y. Marquez & A. Contreras.

Paratypes. 4 males (BMNH, UAT, UNAM, ZISP), same data as holotype.

Etymology. The species is named in honour of Alexandra Elbakyan (Kazakhstan/Russia), creator of the web-site Sci-Hub, in recognition of her contribution to making scientific knowledge available for all researchers.

Distribution. Central Mexico (Tlaxcala).

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References

- Achterberg C, Altenhofer E (1997) *Xyeloblasticus* gen. nov. (Hymenoptera: Braconidae: Blacinae) parasitoid of Xyelinae (Xyelidae: Hymenoptera). Zoologische Mededelingen 71(25): 291–298.
- Blank SM (2002) The Western Palaearctic Xyelidae (Hymenoptera). In: Viitasaari M (Ed.) Sawflies (Hymenoptera, Symphyta) I. A review of the suborder, the Western Palaearctic taxa of Xyeloidea and Pamphilioidea. Tremex Press Ltd., Helsinki, 197–233.
- Blank SM, Shinohara A, Altenhofer E (2013) The Eurasian species of *Xyela* (Hymenoptera, Xyelidae): taxonomy, host plants and distribution. Zootaxa 3629(1): 1–106. <https://doi.org/10.11646/zootaxa.3629.1.1>
- Burdick DJ (1961) A taxonomic and biological study of the genus *Xyela* Dalman in North America. University of California (Berkeley), Publications in Entomology 17(3): 285–355.
- Gao T, Ren D, Shin Ch. (2009) *Abrotoxyela* gen. nov. (Insecta, Hymenoptera, Xyelidae) from the Middle Jurassic of Inner Mongolia, China. Zootaxa 2094: 52–69.
- Gauld ID (1991) The Ichneumonidae of Costa Rica, 1. Introduction, keys to subfamilies, and keys to the species of the lower Pimpliform subfamilies Rhyssinae, Poemeniinae, Acaenitinae and Cylocheriinae. Memoirs of the American Entomological Institute 47: 1–589.
- Hetrick LA (1942) In: Gurney AB Minutes of the 524th regular meeting of the Entomological Society of Washington. Proceedings of the Entomological Society of Washington 44(3): 55–56.

- Horstmann K (1981) Revision der europäischen Tersilochinen II (Hymenoptera, Ichneumonidae). Spixiana Supplement 4(1980): 1–76.
- Horstmann K (2013) Revisions of Nearctic Tersilochinae V. Genera *Allophroides* Horstmann and *Gelanes* Horstmann (partim) (Hymenoptera, Ichneumonidae). Spixiana 36(2): 227–261.
- Kasparyan DR, Tolkanitz VI (1999) Ichneumonidae. Subfamilies Tryphoninae: tribes Sphinctini, Phytodietini, Oedemopsini, Tryphonini (addendum), Idiogrammatini. Subfamilies Eucerotinae, Adelognathinae (addendum), Townesioninae. Fauna of USSR and neighbouring countries. Insecta, Hymenoptera. Volum III, Number 3. Saint Petersburg: “Nauka”. 404 pp.
- Khalaim AI (2002) A review of the species of the genus *Gelanes* (Hymenoptera, Ichneumonidae, Tersilochinae) of the Palaearctic region. Vestnik Zoologii 36(6): 3–12.
- Khalaim AI (2011) Tersilochinae of South, Southeast and East Asia, excluding Mongolia and Japan (Hymenoptera: Ichneumonidae). Zoosystematica Rossica 20(1): 96–148.
- Khalaim AI (2017) Japanese species of *Gelanes* Horstmann (Hymenoptera: Ichneumonidae: Tersilochinae). Russian Entomological Journal 26(1): 45–48.
- Khalaim AI, Blank SM (2011) Review of the European species of the genus *Gelanes* Horstmann (Hymenoptera: Ichneumonidae: Tersilochinae), parasitoids of xyelid sawflies (Hymenoptera: Xyelidae). Proceedings of the Zoological Institute RAS 315(2): 154–166.
- Khalaim AI, Sheng M-L (2015) Contribution to the study of Chinese Tersilochinae (Hymenoptera: Ichneumonidae). Zootaxa 4013(2): 280–286. <https://doi.org/10.11646/zootaxa.4013.2.8>
- Kim K-B, Balueva EN, Khalaim AI, Lee J-W (2013) The genus *Gelanes* Horstmann (Hymenoptera: Ichneumonidae: Tersilochinae) from South Korea, with description of four new species. Zootaxa 3716(3): 417–430. <https://doi.org/10.11646/zootaxa.3716.3.5>
- Noyes JS (1998) Catalogue of the Chalcidoidea of the World. London, CD, version 1.0.
- Peck O (1963) A catalogue of the Nearctic Chalcidoidea (Insecta: Hymenoptera). The Canadian Entomologist, Suppl. 30: 5–1092. <https://doi.org/10.4039/entm9530fv>
- Smith DR (1988) A synopsis of the sawflies (Hymenoptera: Symphyta) of America south of the United States: introduction, Xyelidae, Pamphiliidae, Cimbicidae, Diprionidae, Xiphydriidae, Siricidae, Orussidae, Cephidae. Systematic Entomology 13(2): 205–261. <https://doi.org/10.1111/j.1365-3113.1988.tb00242.x>
- Taeger A, Blank SM, Liston AD (2010) World Catalog of Symphyta (Hymenoptera). Zootaxa 2580: 1–1064.
- Townes HK, Gupta VK, Townes M (1992) The Ichneumon-flies of America North of Mexico. Part 11. Tribes Oedemopsini, Tryphonini and Idiogrammatini (Hymenoptera: Ichneumonidae: Tryphoninae). Memoirs of the American Entomological Institute 50: 1–296.
- Wang M, Rasnitsyn A, Ren D (2014) Two new fossil sawflies (Hymenoptera, Xyelidae, Xyelinae) from the Middle Jurassic of China. Acta Geologica Sinica 88(4): 1801–1840.
- Yates HO III, Smith DR (2009) History, distribution, damage, and life cycle of a pine shoot gall sawfly, *Xyela gallicaulis* (Hymenoptera: Xyelidae). Journal of Entomological Science 44(3): 276–283.
- Yu DSK, Achterberg C, Horstmann K (2012) Taxapad 2012, Ichneumonoidea 2011. Database on flash-drive. Ottawa, Ontario, Canada.